DEPARTMENT OF NATIONAL DEFENCE
CANADA

OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (JOINT & LAND)

DOR(J&L) RESEARCH NOTE RN-9814

A MARGINAL ANALYSIS APPROACH TO RISK MANAGEMENT UNDER THE SCENARIO PLANNING FRAMEWORK

BY

Mr. Ivan Taylor

MAY 1998

OTTAWA, CANADA

National Defence Défense nationale

OPERATIONAL RESEARCH DIVISION

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ABSTRACT

A model is presented which could be used to conduct risk analysis under the scenario planning framework being developed by the Directorate of Defence Analysis (DDA). DDA has presented a minimum set of 11 scenarios based on the commitments that have been described in the 1994 White Paper. They have developed a work program which over the next 12 months will expand these scenarios, identify the defence capabilities required to be successful in these scenarios, quantify these capabilities, and prioritize the Canadian Forces capability development to provide minimum risk at minimum cost. The following model is suggested as a potential method for quantifying the cost/risk relationship in a realistic manner to optimize the capabilities of the Canadian Forces.

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A MARGINAL ANALYSIS APPROACH TO RISK MANAGEMENT

UNDER THE SCENARIO PLANNING FRAMEWORK

INTRODUCTION

1. The Directorate of Defence Analysis (DDA) has presented a framework for Force Development and Defence Planning based on 11 Scenarios drawn from the 1994 White Paper. These 11 Scenarios range from peacetime operations, to peace support operations, to multi-national war:

a. Scenario 1 - Search and Rescue in Canada;

b. Scenario 2 - Disaster Relief in Canada;

c. Scenario 3 - International Humanitarian Relief;

d. Scenario 4 - Surveillance of Canadian Territory and Approaches;

e. Scenario 5 - Evacuation of Canadians Overseas;

f. Scenario 6 - Peace Support Operations (Chapter 6);

g. Scenario 7 - Aid to the Civil Power;

h. Scenario 8 - National Sovereignty and Enforcement of Canadian Interests;

j. Scenario 9 - Peace Support Operations (Chapter 7);

k. Scenario 10 - Defence of Canadian and US Territory; and

m. Scenario 11 - Collective Defence.

These 11 Scenarios represent a minimum set of the Canadian Forces commitments as outlined by the 1994 White Paper and have been approved by the Defence Management Committee (DMC) as the framework under which Force Development and Defence Planning will be conducted in the future.

2. The following paper presents a mathematical model which could be used in conjunction with the Scenario Planning Framework to manage the risk/cost tradeoff.

OPERATIONAL DEMAND DATA

3. In an effort to predict the future, we can look at the likely frequency and duration of these 11 scenarios. This could be based on historical data for some scenarios or based on risk tolerance for more infrequent scenarios. The scenarios can also be prioritized which would suggest some level of concurrence could be tolerated. Table I presents hypothetical data on the frequency, duration and priority of the 11 Scenarios. In this case, we have two groupings "war" scenarios and "peace" scenarios. War preparations would take first priority and once tolerable levels of risk are achieved in these scenarios, we would consider investing in the peacetime scenarios. It should be noted that the capabilities acquired for war footing are also potentially beneficial in peacetime.

TABLE I
EXAMPLE OPERATIONAL DATA ON SCENARIOS

Scenario Description	Expected Occurrences Per Year	Expected Duration of Scenario in Years	Priority
Search and Rescue	5	0.02	2
Disaster in Canada	3	0.33	2
Humanitarian Relief	5	0.50	2
Surveillance	10	0.04	2
Evacuation Overseas	2	0.04	2
Chapter 6 Operations	3	1.00	2
Aid to the Civil Power	0.5	0.50	2
Sovereignty	1	0.25	2
Chapter 7 Operations	2	1.00	2
Defence of Canada / US	0.05	5.00	1
Collective Defence	0.1	5.00	1

CAPABILITY IDENTIFICATION

4. The first step in the process of conducting risk analysis is to identify the capabilities that are required in each of the scenarios. This can only be done when the scenarios are fully expanded using the Operational Estimate Process. This Estimate would be conducted with full input from the environmental commands and would result in a matrix with Scenarios across the columns and the capabilities down the rows filled with 'X's as shown in Table II. The requirement must be justified based on the desired effect expected from that capability and the specified success criteria for the scenario.

TABLE II
RESULTS OF THE CAPABILITY IDENTIFICATION PROCESS

Cap	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5	Scen 6	Scen 7	Scen 8	Scen 9	Scen 10	Scen 11
1	X	X	X	X	X	X	X	X	X	X	X
2	X	0	X	0	X	0	X	0	X	0	X
3	0	X	0	X	0	X	0	X	0	X	0
4	X	X	X	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X	X	X	X
6	0	0	0	0	0	0	0	0	0	X	X
7	X	X	X	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X	X	X	X
9	X	0	0	0	0	0	0	0	0	X	X
10	0	X	0	0	0	0	0	0	0	X	X

CAPABILITY QUANTIFICATION

5. The next obvious step is to quantify the requirement for each capability in each scenario. This quantification must be consistent across the scenarios and must be costed to allow optimization. Another factor that needs to be considered is the utilization rate of the capability. For example, strategic lift might be used at the beginning and the end of the scenario but be free to conduct other operations during the employment phase of the operation. Its utilization rate may be only 20%. Whereas, an infantry unit may need to be rotated every six months and therefore another unit must be prepared to replace them. Its utilization rate may be considered to be 200%. The utilization rate can be used as a multiplier on the demand to increase or decrease the requirement for each capability proportionally. Table III provides hypothetical data for the first 10 capabilities in the 50 capability data set used in the example run of the model.

TABLE III
EXAMPLE DATA ON CAPABILITY QUANTIFICATION

Cap	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5	Scen 6	Scen 7	Scen 8	Scen 9	Scen 10	Scen 11
1	1	1	1	1	1	1	1	1	1	1	1
2	1	0	1	0	1	0	1	0	1	0	1
3	0	1	0	1	0	1	0	1	0	1	0
4	1	2	3	4	5	6	7	8	9	10	11
5	11	10	9	8	7	6	5	4	3	2	1
6	0	0	0	0	0	0	0	0	0	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	2	3	1	2	3	1	2	3	1	2
9	1	0	0	0	0	0	0	0	0	1	1
10	0	1	0	0	0	0	0	0	0	1	1

RISK ANALYSIS

6. We can assume that the scenario expansion process based on the Operational Estimate will provide a good indication of the requirement for capabilities in each scenario to ensure a high probability of success. We will take these estimates as the expected requirements and assume that if the real demand overwhelms the capabilities this would result in operational failure. Therefore a reserve capability is required to compensate for unexpected demand. In our model, we assume Poisson demand for resources and exponential usage of capabilities. The model utilizes a reliability formulation to compute the risk of failure. That is, the model is a combination of series connections of capabilities with parallel redundancy through reserve forces which can be used to estimate the probability that demand may exceed resources. This allows us to apply marginal analysis to optimize the risk/cost relationship.

7. The model begins with a user-specified minimum set of capabilities and calculates the risk associated with this capability mix against the scenarios in the first priority set. Then the model calculates the capability that provides the "best bang for the buck" to add to the capability mix and recalculates the risk. The model continues to add capabilities

one at a time until the risk is reduced to a user-specified acceptable level for the first priority scenarios.

8. The next priority scenario set is then considered and the values of the capabilities that have been determined as a result of the first priority scenarios are used as a starting point for further calculations. Again, "bang for the buck" calculations are used to determine the next capability to invest in to reduce the risk. The calculations continue until the risk in the second priority scenarios is reduced to the user-specified level.

9. Further priority sets could be specified, however, the process is the same.

10. The model results can be presented graphically as shown in Figure 1. Notice that the left hand curve starts at a positive value of cost based on the user-specified minimum quantities of each capability. Then additional investment is required to begin reducing the risk. When the risk is reduced to 15%, a situation of diminishing returns sets in so that more and more investment is required to remove the last few percentages of risk. When the first priority scenarios are satisfied, the model can consider the second priority scenarios. The right hand curve represents the peacetime scenarios. The risk returns to a high level in this case because there is not a good match between the requirements for peacetime and wartime capabilities in our example data set. However, additional investment can reduce the risk to acceptable levels.

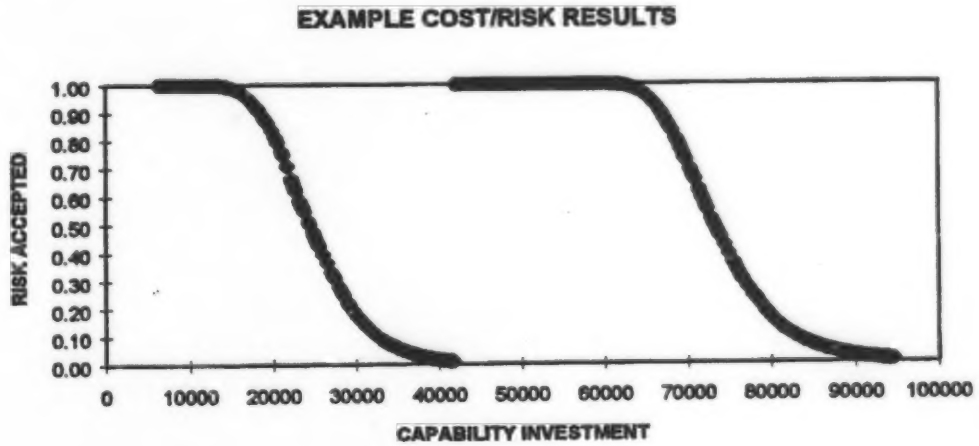

Figure 1: Example Results

11. It should be noted that each point on the curve is a mix of capabilities at optimal levels. That is, if you specify the acceptable risk, the model will calculate the minimum cost capability mix to meet that risk target. Similarly, you can work backward to determine the optimal capability mix and the associated risk that Senior Leadership would have to accept if an overall maximum investment level was specified. Furthermore, at any point along the curve, the capabilities are prioritized so that the analyst can determine in which area further investment would reduce the risk the most. Or alternatively, if reductions are required in the current budget, the areas where reduction would result in minimum incremental risk can be determined by the model.

12. It would be valuable to run the model from a zero-base, that is, with initial capability levels set to zero. Then allow the program to generate the optimal capability mix in terms of risk and investment and compare that with the current set of force capabilities. It may be quite possible that the current force capabilities is incurring more cost and requiring acceptance of more risk than necessary and through a long-term plan of investing in some capabilities and divesting others, the Canadian Forces could both save money and reduce risk at the same time (see Figure 2).

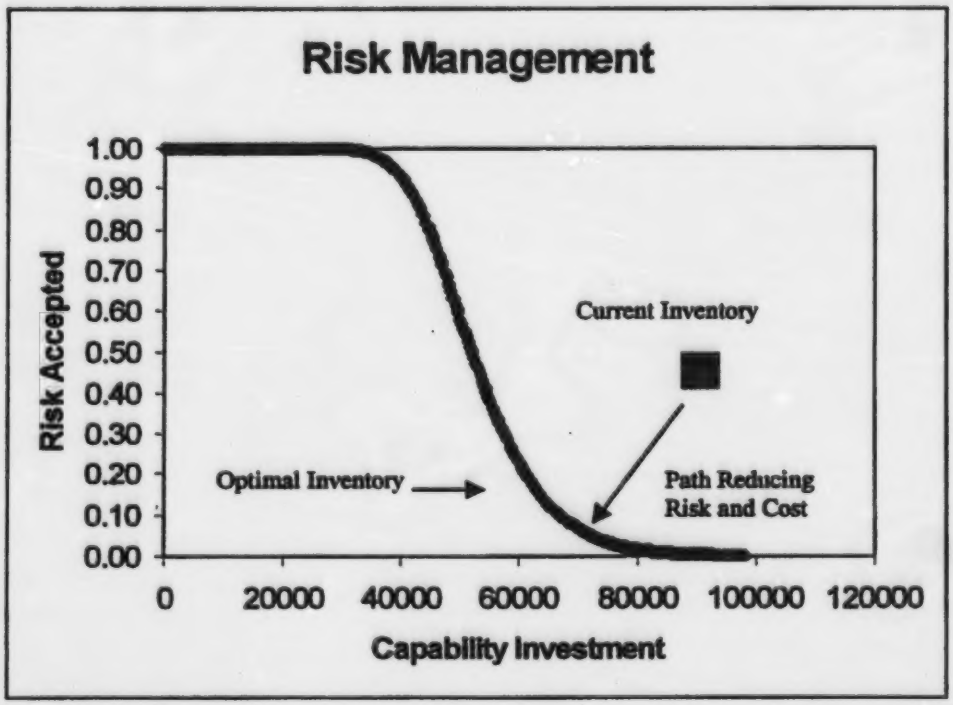

Figure 2: Risk Management

CONCLUDING REMARKS

13. As with any operational research model, the results are only as good as the input that is provided. The process of scenario expansion using the Operational Estimate, the capability identification and quantification will provide the data necessary to use this model to optimize the force capabilities to minimize cost and risk. This is the ultimate goal of the Scenario Based Planning Framework. In the end, we may find that "we get what we pay for" and to reduce risk to acceptable levels, the Canadian Forces may have to increase investment in some capabilities. However, the use of this type of model will ensure that the money allocated to Defence will be used to reduce risk as much as possible.

ANNEX A
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THE COST/RISK PROGRAM

```
c234567
c    This program uses marginal analysis to optimize the capabilities
c    in the Canadian Forces under the Scenario Framework.
c
     double precision arrrate(50),prob(50),xmarg(50),
    1                 totprob(50),capcost(50),targ(11),caparr(50,11),
    2                 scendur(11),scenarr(11),capute(50),total,
    3                 totcost,oldprob,arrtot,b,best,totrisk
     integer newcaps(50),nprior(11),norder(999),nflag(50),mincaps(50)
     character*25 capname(50),scenname(11)
c
c     print*,'The Capability Optimizer'
     read(*,*)
     read(*,*)
c     print*,'Number of Scenarios'
     read(*,*)
     read(*,*) numscen
     read(*,*)
     read(*,*)
     numpri=0
     do 50 i=1,numscen
       read(*,*) scenname(i),scenarr(i),scendur(i),nprior(i)
       if (nprior(i).gt.numpri) then
         numpri=nprior(i)
       endif
  50 continue
     read(*,*)
c     print*,'Number of Capabilities'
     read(*,*)
     read(*,*) numcaps
     read(*,*)
```

```
c     print*,'Enter Capability Data'
      read(*,*)
      read(*,*)
      do 100 i=1,numcaps
        read(*,*) capname(i),capcost(i),mincaps(i),
     1          (caparr(i,j),j=1,numscen),capute(i)
c       print*,capname(i)
  100 continue
      read(*,*)
c     print*,'Target Risk Levels by Priorities'
c     print*,numpri
      read(*,*)
      do 110 i=1,numpri
        read(*,*) targ(i)
  110 continue
c
c     marginal analysis technique
c
      nbuy=0
      do 650 m=1,numpri
        total=1.0
        totcost=0.0
        do 300 i=1,numcaps
          nflag(i)=1
          arrrate(i)=0.0
          do 200 j=1,numscen
            if (nprior(j).eq.m) then
              if (caparr(i,j).gt.0.0) then
                arrrate(i)=arrrate(i)+scenarr(j)
     1                    *scendur(j)*caparr(i,j)
              endif
            endif
  200     continue
          if (arrrate(i).eq.0.0) then
            nflag(i)=0
          endif
```

```
          prob(i)=exp(-arrrate(i)*capute(i))
          xmarg(i)=(arrrate(i)*capute(i))
          totprob(i)=prob(i)
          total=total*totprob(i)
          newcaps(i)=0
          if (mincaps(i).ne.0) then
            do 230 j=1,mincaps(i)
              oldprob=totprob(i)
              prob(i)=prob(i)*xmarg(i)
              xmarg(i)=(arrrate(i)*capute(i))
     1                 /(float(j)+1.0)
              totprob(i)=totprob(i)+prob(i)
              total=total*totprob(i)/oldprob
              totcost=totcost+capcost(i)
              newcaps(i)=newcaps(i)+1
    230       continue
          endif
    300   continue
          if (nbuy.ne.0) then
            do 330 i=1,nbuy
              j=norder(i)
              newcaps(j)=newcaps(j)+1
              prob(j)=prob(j)*xmarg(j)
              oldprob=totprob(j)
              totprob(j)=totprob(j)+prob(j)
              totcost=totcost+capcost(j)
              total=total*totprob(j)/oldprob
              xmarg(j)=(arrrate(j)*capute(j))
     1                 /(float(newcaps(j))+1.0)
    c         if (m.eq.numpri) then
    c           print*,totcost,(1.0-total),capname(j),newcaps(j)
    c         endif
    330     continue
          endif
    350   best=0.0
          do 400 i=1,numcaps
```

```
        if (nflag(i).ne.0) then
          b=total*(totprob(i)+prob(i)*xmarg(i))/totprob(i)
          b=(b-total)/capcost(i)
c          print*,i,b
          if (b.gt.best) then
            best=b
            k=i
          endif
        endif
 400   continue
c      stop
       nbuy=nbuy+1
       norder(nbuy)=k
       newcaps(k)=newcaps(k)+1
       prob(k)=prob(k)*xmarg(k)
       oldprob=totprob(k)
       totprob(k)=totprob(k)+prob(k)
       xmarg(k)=(arrrate(k)*capute(k))
     1         /(float(newcaps(k))+1.0)
       total=total*totprob(k)/oldprob
       totcost=totcost+capcost(k)
c      if (m.eq.numpri) then
         write(*,1000) totcost,(1.0-total),capname(k),newcaps(k)
 1000      format(' ',f15.0,f15.7,'   ',a25,i10)
c      endif
c      if (nbuy.gt.5) stop
       if ((1.0-total).gt.targ(m)) goto 350
       print*
       if (m.eq.numpri) then
         write(*,1500)
 1500      format(' Final Results')
         do 600 i=1,numcaps
c          if(nflag(i).ne.0) then
             write(*,2000) capname(i),newcaps(i),(1.0-totprob(i))
 2000          format(' ',a25,i10,f20.7)
c          endif
```

```
 600      continue
          totrisk=1.0-total
          write(*,3000) totrisk
3000      format(' Total Risk ',f15.7)
          write(*,4000) totcost
4000      format(' Total Cost ',f15.0)
        endif
 650 continue
    stop
    end
```

ANNEX B
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THE COST/RISK DATA FILE

Capability Optimizer Data File

Number of Scenarios
11

Scenario Data

	Arrivals	Duration	Priority
'Search and Rescue'	5	0.02	2
'Disaster in Canada'	3	0.33	2
'Humanitarian Relief'	5	0.50	2
'Surviellance'	10	0.04	2
'Evacuation'	2	0.04	2
'Chapter 6'	3	1.00	2
'Civil Power'	0.5	0.50	2
'Soveriegnty'	1	0.25	2
'Chapter 7'	2	1.00	2
'Canada/US'	.05	5.00	1
'Collective Defence'	0.1	5.00	1

Number of Capabilities
50

Demand Data

	Cost	Minimum	Demand By Scenario											Ute Rate
			1	2	3	4	5	6	7	8	9	10	11	1.0
'Cap 1'	100	1	1	1	1	1	1	1	1	1	1	1	1	1.0
'Cap 2'	100	1	1	0	1	0	1	0	1	0	1	0	1	1.0
'Cap 3'	200	1	0	1	0	1	0	1	0	1	0	1	0	0.5
'Cap 4'	100	1	1	2	3	4	5	6	7	8	9	10	11	1.0
'Cap 5'	200	1	11	10	9	8	7	6	5	4	3	2	1	1.0
'Cap 6'	500	1	0	0	0	0	0	0	0	0	0	1	1	2.0
'Cap 7'	500	1	1	1	1	1	1	1	1	1	1	1	1	1.0
'Cap 8'	200	1	1	2	3	1	2	3	1	2	3	1	2	1.0
'Cap 9'	200	1	1	0	0	0	0	0	0	0	0	1	1	1.0

'Cap 10'	400	1	0	1	0	0	0	0	0	0	0	1	1	3.0
'Cap 11'	500	1	0	0	1	0	0	0	0	0	1	2	2	1.0
'Cap 12'	10	1	0	0	0	1	0	0	0	0	1	3	5	1.0
'Cap 13'	20	1	0	0	0	0	1	0	0	0	1	1	1	1.0
'Cap 14'	30	1	0	0	0	0	0	1	0	0	3	5	10	1.0
'Cap 15'	40	1	0	0	0	0	0	0	1	0	1	1	2	1.0
'Cap 16'	50	1	0	0	0	0	0	0	0	1	0	1	1	1.0
'Cap 17'	60	1	0	0	0	0	0	0	0	0	1	1	3	1.0
'Cap 18'	70	1	1	0	0	0	0	0	0	0	1	1	5	1.0
'Cap 19'	80	1	0	0	0	0	0	0	0	0	0	1	1	1.0
'Cap 20'	90	1	1	1	0	0	0	0	0	0	0	1	4	2.0
'Cap 21'	500	1	0	0	1	0	0	0	0	0	1	3	2	1.0
'Cap 22'	10	1	0	0	0	1	0	0	0	0	0	1	3	1.0
'Cap 23'	20	1	0	0	0	0	1	0	0	0	0	1	1	1.0
'Cap 24'	30	1	0	0	0	0	0	1	0	0	0	1	1	1.0
'Cap 25'	40	1	0	0	0	0	0	0	1	0	1	5	5	1.0
'Cap 26'	50	1	0	0	0	0	0	0	0	1	1	3	2	1.0
'Cap 27'	60	1	0	0	0	0	0	0	0	0	1	1	2	1.0
'Cap 28'	70	1	1	0	0	0	0	0	0	0	0	1	1	1.0
'Cap 29'	80	1	0	0	0	0	0	0	0	0	0	3	1	1.0
'Cap 30'	90	1	1	1	0	0	0	0	0	0	0	1	1	0.5
'Cap 31'	500	1	0	0	1	0	0	0	0	0	1	4	5	1.0
'Cap 32'	10	1	0	0	0	1	0	0	0	0	1	2	4	1.0
'Cap 33'	20	1	0	0	0	0	1	0	0	0	1	2	4	1.0
'Cap 34'	30	1	0	0	0	0	0	1	0	0	1	3	5	1.0
'Cap 35'	40	1	0	0	0	0	0	0	1	0	1	5	3	1.0
'Cap 36'	50	1	0	0	0	0	0	0	0	1	1	3	4	1.0
'Cap 37'	60	1	0	0	0	0	0	0	0	0	1	1	1	1.0
'Cap 38'	70	1	1	0	0	0	0	0	0	0	1	1	2	1.0
'Cap 39'	80	1	0	0	0	0	0	0	0	0	0	1	1	1.0
'Cap 40'	90	1	1	1	0	0	0	0	0	0	1	1	3	0.1
'Cap 41'	500	1	0	0	1	0	0	0	0	0	0	1	1	0.5
'Cap 42'	10	1	0	0	0	1	0	0	0	0	0	1	5	1.0
'Cap 43'	20	1	0	0	0	0	1	0	0	0	1	2	5	1.0
'Cap 44'	30	1	0	0	0	0	0	1	0	0	1	3	6	1.0
'Cap 45'	40	1	0	0	0	0	0	0	1	0	1	4	7	1.0

'Cap 46'	50	1	0	0	0	0	0	0	0	1	1	2	2	1.0
'Cap 47'	60	1	0	0	0	0	0	0	0	0	1	4	4	1.0
'Cap 48'	70	1	1	0	0	0	0	0	0	0	1	1	1	2.0
'Cap 49'	80	1	0	0	0	0	0	0	0	0	1	3	1	1.0
'Cap 50'	90	1	1	1	0	0	0	0	0	0	2	1	1	1.0

Target Risk Levels By Priority

0.01

0.01

ANNEX C
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THE COST/RISK OUTPUT FILE

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
6310.	1.0000000	Cap 12	2
6320.	1.0000000	Cap 42	2
6350.	1.0000000	Cap 14	2
6360.	1.0000000	Cap 32	2
6370.	1.0000000	Cap 12	3
6390.	1.0000000	Cap 43	2
6400.	1.0000000	Cap 22	2
6430.	1.0000000	Cap 14	3
6460.	1.0000000	Cap 44	2
6470.	1.0000000	Cap 42	3
6510.	1.0000000	Cap 45	2
6530.	1.0000000	Cap 33	2
6560.	1.0000000	Cap 34	2
6570.	1.0000000	Cap 32	3
6610.	1.0000000	Cap 25	2
6710.	1.0000000	Cap 4	2
6740.	1.0000000	Cap 14	4
6750.	1.0000000	Cap 12	4
6770.	1.0000000	Cap 43	3
6810.	1.0000000	Cap 35	2
6840.	1.0000000	Cap 44	3
6880.	1.0000000	Cap 45	3
6890.	1.0000000	Cap 42	4
6900.	1.0000000	Cap 22	3
7000.	1.0000000	Cap 4	3
7090.	1.0000000	Cap 20	2
7120.	1.0000000	Cap 14	5
7170.	1.0000000	Cap 36	2
7200.	1.0000000	Cap 34	3
7220.	1.0000000	Cap 33	3
7280.	1.0000000	Cap 47	2
7320.	1.0000000	Cap 25	3
7330.	1.0000000	Cap 32	4
7340.	1.0000000	Cap 12	5
7410.	1.0000000	Cap 18	2
7450.	1.0000000	Cap 45	4
7550.	1.0000000	Cap 4	4

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
7580.	1.0000000	Cap 44	4
7610.	1.0000000	Cap 14	6
7630.	1.0000000	Cap 43	4
7670.	1.0000000	Cap 35	3
7720.	1.0000000	Cap 26	2
7810.	1.0000000	Cap 20	3
7840.	1.0000000	Cap 34	4
7880.	1.0000000	Cap 25	4
7890.	1.0000000	Cap 42	5
7950.	1.0000000	Cap 17	2
8000.	1.0000000	Cap 36	3
8100.	1.0000000	Cap 4	5
8150.	1.0000000	Cap 46	2
8210.	1.0000000	Cap 47	3
8230.	1.0000000	Cap 33	4
8270.	1.0000000	Cap 15	2
8300.	1.0000000	Cap 14	7
8320.	1.0000000	Cap 23	2
8340.	1.0000000	Cap 13	2
8380.	1.0000000	Cap 45	5
8390.	1.0000000	Cap 22	4
8400.	1.0000000	Cap 32	5
8430.	1.0000000	Cap 44	5
8440.	1.0000000	Cap 12	6
8510.	1.0000000	Cap 18	3
8580.	1.0000000	Cap 48	2
8680.	.9999999	Cap 4	6
8700.	.9999999	Cap 43	5
8790.	.9999999	Cap 20	4
8850.	.9999999	Cap 27	2
8890.	.9999998	Cap 35	4
8930.	.9999998	Cap 25	5
8960.	.9999998	Cap 24	2
8990.	.9999997	Cap 14	8
9020.	.9999997	Cap 34	5
9090.	.9999996	Cap 38	2
9130.	.9999995	Cap 45	6
9230.	.9999992	Cap 4	7
9310.	.9999990	Cap 49	2
9390.	.9999986	Cap 29	2
9440.	.9999983	Cap 36	4
9500.	.9999979	Cap 47	4

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
9550.	.9999975	Cap 26	3
9560.	.9999974	Cap 42	6
9580.	.9999972	Cap 33	5
9610.	.9999969	Cap 44	6
9700.	.9999959	Cap 20	5
9760.	.9999950	Cap 17	3
9810.	.9999942	Cap 16	2
9840.	.9999936	Cap 14	9
9890.	.9999927	Cap 46	3
9960.	.9999911	Cap 18	4
9970.	.9999908	Cap 12	7
10070.	.9999880	Cap 4	8
10080.	.9999876	Cap 32	6
10120.	.9999862	Cap 25	6
10140.	.9999855	Cap 43	6
10640.	.9999657	Cap 31	2
10680.	.9999620	Cap 15	3
10740.	.9999559	Cap 37	2
10780.	.9999515	Cap 45	7
10790.	.9999504	Cap 22	5
10830.	.9999455	Cap 35	5
10860.	.9999416	Cap 34	6
10930.	.9999322	Cap 28	2
11000.	.9999217	Cap 48	3
11100.	.9999053	Cap 4	9
11160.	.9998936	Cap 47	5
11250.	.9998742	Cap 20	6
11330.	.9998540	Cap 39	2
11410.	.9998305	Cap 19	2
11460.	.9998139	Cap 36	5
11860.	.9996690	Cap 10	2
11890.	.9996511	Cap 14	10
11950.	.9996136	Cap 27	3
12040.	.9995516	Cap 50	2
12070.	.9995277	Cap 44	7
12270.	.9993637	Cap 8	2
12290.	.9993416	Cap 13	3
12310.	.9993189	Cap 23	3
12410.	.9992094	Cap 1	2
12420.	.9991972	Cap 42	7
12490.	.9991110	Cap 38	3
12540.	.9990438	Cap 26	4

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
12560.	.9990160	Cap 33	6
12630.	.9989197	Cap 18	5
12730.	.9987700	Cap 4	10
13230.	.9979428	Cap 31	3
13310.	.9977219	Cap 29	3
13390.	.9974772	Cap 49	3
13430.	.9973429	Cap 25	7
13470.	.9972081	Cap 45	8
13530.	.9969973	Cap 17	4
13730.	.9962466	Cap 5	2
13740.	.9962008	Cap 12	8
13770.	.9960693	Cap 24	3
13790.	.9959815	Cap 43	7
14290.	.9937439	Cap 21	2
14380.	.9931238	Cap 20	7
14410.	.9929111	Cap 34	7
14450.	.9926212	Cap 35	6
14460.	.9925468	Cap 32	7
14510.	.9921714	Cap 46	4
14540.	.9919439	Cap 14	11
14600.	.9915006	Cap 47	6
15100.	.9876759	Cap 11	2
15600.	.9821300	Cap 6	2
15700.	.9805489	Cap 4	11
15800.	.9789279	Cap 2	2
16200.	.9720083	Cap 10	3
16250.	.9708638	Cap 36	6
16450.	.9661812	Cap 9	2
16480.	.9653796	Cap 44	8
16520.	.9643304	Cap 15	4
16590.	.9625337	Cap 48	4
17090.	.9493513	Cap 31	4
17100.	.9489969	Cap 22	6
17150.	.9472314	Cap 16	3
17190.	.9459578	Cap 45	9
17230.	.9446769	Cap 25	8
17300.	.9424148	Cap 18	6
17360.	.9404214	Cap 37	3
17450.	.9373748	Cap 30	2
17540.	.9341984	Cap 20	8
17640.	.9306324	Cap 4	12
17840.	.9231832	Cap 8	3

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
17850.	.9227819	Cap 42	8
17910.	.9204418	Cap 27	4
17930.	.9196396	Cap 33	7
18000.	.9168579	Cap 28	3
18050.	.9148145	Cap 26	5
18080.	.9135618	Cap 14	12
18090.	.9131858	Cap 12	9
18160.	.9105550	Cap 38	4
18240.	.9074588	Cap 19	3
18320.	.9042554	Cap 39	3
18820.	.8842795	Cap 21	3
18840.	.8833307	Cap 43	8
18900.	.8804634	Cap 17	5
18930.	.8790059	Cap 34	8
18970.	.8771387	Cap 35	7
19060.	.8728858	Cap 50	3
19140.	.8690337	Cap 29	4
19220.	.8650648	Cap 49	4
19280.	.8620486	Cap 47	7
19780.	.8369152	Cap 31	5
20180.	.8142381	Cap 10	4
20280.	.8078079	Cap 1	3
20480.	.7949951	Cap 5	3
20510.	.7930174	Cap 44	9
21010.	.7597523	Cap 7	2
21110.	.7521521	Cap 4	13
21130.	.7505973	Cap 23	4
21150.	.7490328	Cap 13	4
21160.	.7482498	Cap 32	8
21660.	.7091851	Cap 11	3
22160.	.6640587	Cap 6	3
22210.	.6588742	Cap 36	7
22260.	.6539664	Cap 46	5
22350.	.6456144	Cap 20	9
22390.	.6418560	Cap 45	10
22430.	.6384010	Cap 25	9
22460.	.6358816	Cap 14	13
22530.	.6302623	Cap 18	7
22560.	.6279428	Cap 24	4
22630.	.6225900	Cap 48	5
22670.	.6198148	Cap 15	5
23170.	.5856366	Cap 31	6

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
23270.	.5783758	Cap 4	14
23280.	.5776435	Cap 22	7
23480.	.5630235	Cap 9	3
23490.	.5623296	Cap 42	9
23510.	.5609642	Cap 33	8
23710.	.5476594	Cap 8	4
24210.	.5134977	Cap 21	4
24240.	.5113815	Cap 34	9
24330.	.5050138	Cap 40	2
24340.	.5043171	Cap 12	10
24390.	.5008492	Cap 26	6
24790.	.4734286	Cap 10	5
24850.	.4691112	Cap 47	8
24870.	.4676721	Cap 43	9
24910.	.4648910	Cap 35	8
25010.	.4580306	Cap 2	3
25060.	.4546307	Cap 16	4
25120.	.4506205	Cap 27	5
25150.	.4486520	Cap 44	10
25240.	.4428048	Cap 20	10
25300.	.4389065	Cap 17	6
25340.	.4364977	Cap 45	11
25410.	.4323541	Cap 38	5
25470.	.4287931	Cap 37	4
25520.	.4258089	Cap 36	8
25550.	.4240353	Cap 14	14
26050.	.3945826	Cap 41	2
26550.	.3640858	Cap 6	4
27050.	.3320528	Cap 11	4
27130.	.3271412	Cap 49	5
27210.	.3221935	Cap 29	5
27310.	.3159682	Cap 4	15
27380.	.3116771	Cap 28	4
27420.	.3092108	Cap 25	10
27430.	.3086140	Cap 32	9
27930.	.2801000	Cap 31	7
28010.	.2755839	Cap 19	4
28090.	.2710395	Cap 39	4
28290.	.2596495	Cap 5	4
28360.	.2557816	Cap 18	8
28410.	.2531428	Cap 46	6
28500.	.2484576	Cap 50	4

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
29000.	.2224426	Cap 7	3
29090.	.2177142	Cap 30	3
29190.	.2128068	Cap 1	4
29260.	.2100156	Cap 48	6
29760.	.1906004	Cap 21	5
30160.	.1747947	Cap 10	6
30250.	.1712521	Cap 20	11
30280.	.1700856	Cap 34	10
30300.	.1693095	Cap 23	5
30320.	.1685327	Cap 13	5
30420.	.1647491	Cap 4	16
30480.	.1624849	Cap 47	9
30490.	.1621198	Cap 42	10
30510.	.1613959	Cap 33	9
30540.	.1603199	Cap 14	15
30550.	.1599712	Cap 12	11
30580.	.1589488	Cap 44	11
30600.	.1582667	Cap 43	10
30640.	.1569174	Cap 45	12
30680.	.1555785	Cap 35	9
30720.	.1542944	Cap 15	6
30730.	.1539736	Cap 22	8
30930.	.1477525	Cap 8	5
30980.	.1462722	Cap 26	7
31180.	.1403436	Cap 3	2
31680.	.1254469	Cap 31	8
31730.	.1240581	Cap 36	9
31930.	.1185631	Cap 9	4
31960.	.1177389	Cap 24	5
32000.	.1166650	Cap 25	11
32060.	.1151307	Cap 17	7
32560.	.1023999	Cap 6	5
33060.	.0894860	Cap 11	5
33120.	.0881013	Cap 27	6
33190.	.0866532	Cap 18	9
33260.	.0852642	Cap 38	6
33270.	.0850668	Cap 32	10
33370.	.0831165	Cap 4	17
33450.	.0817221	Cap 29	6
33530.	.0803257	Cap 49	6
33580.	.0794656	Cap 16	5
33670.	.0779900	Cap 20	12

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
33700.	.0775285	Cap 14	16
33800.	.0760689	Cap 2	4
33860.	.0752049	Cap 37	5
34260.	.0695114	Cap 10	7
34460.	.0666483	Cap 5	5
34510.	.0659417	Cap 46	7
35010.	.0594068	Cap 21	6
35050.	.0588857	Cap 45	13
35080.	.0584949	Cap 34	11
35140.	.0577313	Cap 47	10
35210.	.0568501	Cap 28	5
35710.	.0506026	Cap 31	9
35740.	.0502419	Cap 44	12
36240.	.0442839	Cap 7	4
36740.	.0384721	Cap 41	3
36820.	.0375729	Cap 19	5
36900.	.0366729	Cap 39	5
36910.	.0365646	Cap 12	12
36930.	.0363517	Cap 43	11
36970.	.0359315	Cap 35	10
36980.	.0358265	Cap 42	11
37050.	.0350965	Cap 48	7
37070.	.0348883	Cap 33	10
37160.	.0339858	Cap 50	5
37200.	.0336188	Cap 25	12
37300.	.0327052	Cap 4	18
37400.	.0318007	Cap 1	5
37450.	.0313785	Cap 36	10
37540.	.0306516	Cap 40	3
37740.	.0291775	Cap 8	6
37790.	.0288093	Cap 26	8
37800.	.0287377	Cap 22	9
38300.	.0252938	Cap 6	6
38800.	.0218377	Cap 11	6
38840.	.0215724	Cap 15	7
38900.	.0212013	Cap 17	8
38990.	.0206467	Cap 30	4
39060.	.0202197	Cap 18	10
39150.	.0196769	Cap 20	13
39180.	.0194966	Cap 14	17
39200.	.0193821	Cap 23	6
39220.	.0192675	Cap 13	6

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
39230.	.0192195	Cap 32	11
39430.	.0183023	Cap 9	5
39930.	.0160413	Cap 31	10
39990.	.0157745	Cap 27	7
40030.	.0155993	Cap 45	14
40430.	.0139052	Cap 10	8
40530.	.0135131	Cap 4	19
40560.	.0133979	Cap 24	6
40630.	.0131304	Cap 38	7
40660.	.0130194	Cap 34	12
40720.	.0128013	Cap 47	11
40750.	.0126931	Cap 44	13
41250.	.0109783	Cap 21	7
41330.	.0107101	Cap 49	7
41410.	.0104418	Cap 29	7
41460.	.0103015	Cap 46	8
41470.	.0102737	Cap 12	13
41490.	.0102190	Cap 43	12
41530.	.0101106	Cap 25	13
41570.	.0100027	Cap 35	11
41770.	.0094966	Cap 5	6
41970.	1.0000000	Cap 5	7
42170.	1.0000000	Cap 5	8
42370.	1.0000000	Cap 5	9
42570.	1.0000000	Cap 5	10
42770.	1.0000000	Cap 5	11
42970.	1.0000000	Cap 5	12
43170.	1.0000000	Cap 5	13
43370.	1.0000000	Cap 5	14
43570.	1.0000000	Cap 5	15
43670.	1.0000000	Cap 4	20
43870.	1.0000000	Cap 5	16
43970.	1.0000000	Cap 4	21
44170.	1.0000000	Cap 8	7
44270.	1.0000000	Cap 4	22
44470.	1.0000000	Cap 5	17
44570.	1.0000000	Cap 4	23
44770.	1.0000000	Cap 5	18
44870.	1.0000000	Cap 4	24
45070.	1.0000000	Cap 5	19
45270.	1.0000000	Cap 8	8

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
45370.	1.0000000	Cap 4	25
45570.	1.0000000	Cap 5	20
45770.	1.0000000	Cap 5	21
45870.	1.0000000	Cap 4	26
46070.	1.0000000	Cap 8	9
46270.	1.0000000	Cap 5	22
46370.	1.0000000	Cap 4	27
46570.	1.0000000	Cap 5	23
46670.	1.0000000	Cap 4	28
46770.	1.0000000	Cap 1	6
46970.	1.0000000	Cap 8	10
47170.	1.0000000	Cap 5	24
47270.	1.0000000	Cap 4	29
47470.	1.0000000	Cap 5	25
47570.	1.0000000	Cap 4	30
47770.	1.0000000	Cap 5	26
47970.	1.0000000	Cap 8	11
48070.	1.0000000	Cap 4	31
48270.	1.0000000	Cap 5	27
48370.	1.0000000	Cap 4	32
48570.	1.0000000	Cap 5	28
48770.	1.0000000	Cap 8	12
48870.	1.0000000	Cap 1	7
48970.	1.0000000	Cap 4	33
49170.	1.0000000	Cap 5	29
49370.	1.0000000	Cap 5	30
49470.	1.0000000	Cap 4	34
49670.	1.0000000	Cap 8	13
49870.	1.0000000	Cap 5	31
49970.	1.0000000	Cap 4	35
50170.	1.0000000	Cap 5	32
50270.	1.0000000	Cap 4	36
50470.	1.0000000	Cap 5	33
50670.	1.0000000	Cap 8	14
50770.	1.0000000	Cap 1	8
50970.	1.0000000	Cap 5	34
51070.	1.0000000	Cap 4	37
51270.	1.0000000	Cap 5	35
51370.	1.0000000	Cap 4	38
51570.	1.0000000	Cap 8	15
51770.	1.0000000	Cap 5	36
51870.	1.0000000	Cap 4	39

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
51970.	1.0000000	Cap 2	5
52170.	1.0000000	Cap 5	37
52370.	1.0000000	Cap 8	16
52570.	1.0000000	Cap 5	38
52670.	1.0000000	Cap 4	40
52870.	1.0000000	Cap 5	39
52970.	1.0000000	Cap 1	9
53070.	1.0000000	Cap 4	41
53270.	1.0000000	Cap 8	17
53470.	1.0000000	Cap 5	40
53570.	1.0000000	Cap 4	42
53770.	1.0000000	Cap 5	41
53970.	1.0000000	Cap 5	42
54170.	.9999999	Cap 8	18
54270.	.9999999	Cap 4	43
54360.	.9999999	Cap 50	6
54560.	.9999999	Cap 5	43
54660.	.9999998	Cap 4	44
54860.	.9999998	Cap 5	44
55060.	.9999996	Cap 8	19
55560.	.9999992	Cap 7	5
55660.	.9999990	Cap 1	10
55860.	.9999985	Cap 5	45
55960.	.9999982	Cap 4	45
56060.	.9999977	Cap 2	6
56260.	.9999968	Cap 5	46
56460.	.9999954	Cap 8	20
56560.	.9999944	Cap 4	46
56760.	.9999921	Cap 5	47
56960.	.9999890	Cap 5	48
57060.	.9999869	Cap 4	47
57260.	.9999821	Cap 8	21
57460.	.9999756	Cap 5	49
57960.	.9999542	Cap 7	6
58160.	.9999383	Cap 3	3
58260.	.9999278	Cap 4	48
58360.	.9999156	Cap 1	11
58560.	.9998871	Cap 5	50
58650.	.9998708	Cap 50	7
58850.	.9998298	Cap 8	22
59050.	.9997762	Cap 5	51
59150.	.9997421	Cap 4	49

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
59350.	.9996668	Cap 5	52
59450.	.9996215	Cap 4	50
59650.	.9995189	Cap 8	23
59850.	.9993886	Cap 5	53
59950.	.9993082	Cap 2	7
60450.	.9988672	Cap 7	7
60650.	.9985831	Cap 5	54
60750.	.9984126	Cap 4	51
60950.	.9980452	Cap 5	55
61050.	.9978194	Cap 1	12
61250.	.9973176	Cap 8	24
61450.	.9967458	Cap 5	56
61550.	.9964008	Cap 4	52
61750.	.9956961	Cap 5	57
61950.	.9948623	Cap 8	25
62450.	.9924695	Cap 7	8
62550.	.9917704	Cap 4	53
62750.	.9902949	Cap 5	58
62840.	.9895157	Cap 50	8
63040.	.9877998	Cap 5	59
63240.	.9858284	Cap 8	26
63340.	.9846840	Cap 4	54
63440.	.9835167	Cap 1	13
63640.	.9810580	Cap 3	4
63670.	.9806346	Cap 24	7
63870.	.9777517	Cap 5	60
63970.	.9761593	Cap 2	8
64070.	.9744969	Cap 4	55
64570.	.9658799	Cap 7	9
64770.	.9612768	Cap 5	61
64970.	.9561114	Cap 8	27
65170.	.9507671	Cap 5	62
65270.	.9478256	Cap 4	56
65340.	.9458184	Cap 48	8
65540.	.9398894	Cap 5	63
65740.	.9333479	Cap 8	28
65840.	.9299639	Cap 4	57
66040.	.9231088	Cap 5	64
66140.	.9193864	Cap 1	14
66640.	.8999030	Cap 7	10
66730.	.8956956	Cap 50	9
66930.	.8865565	Cap 8	29

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
67130.	.8766745	Cap 5	65
67230.	.8714010	Cap 4	58
67430.	.8614851	Cap 5	66
67530.	.8564172	Cap 2	9
67630.	.8512947	Cap 4	59
67830.	.8409561	Cap 8	30
68030.	.8301637	Cap 5	67
68530.	.8014033	Cap 7	11
68730.	.7894422	Cap 3	5
68930.	.7769456	Cap 5	68
69030.	.7703722	Cap 4	60
69130.	.7636074	Cap 1	15
69160.	.7616692	Cap 24	8
69360.	.7487304	Cap 8	31
69560.	.7357731	Cap 5	69
69630.	.7312051	Cap 48	9
69730.	.7247304	Cap 4	61
70230.	.6929388	Cap 7	12
70320.	.6866343	Cap 50	10
70520.	.6726921	Cap 5	70
70540.	.6713179	Cap 13	7
70740.	.6576244	Cap 8	32
70800.	.6534363	Cap 37	6
71300.	.6190894	Cap 11	7
71400.	.6116717	Cap 4	62
71600.	.5968752	Cap 5	71
71700.	.5898604	Cap 2	10
71800.	.5828403	Cap 1	16
72000.	.5693342	Cap 5	72
72200.	.5558207	Cap 8	33
72300.	.5489078	Cap 4	63
72800.	.5145266	Cap 7	13
73000.	.5012809	Cap 5	73
73100.	.4951511	Cap 4	64
73300.	.4834555	Cap 8	34
73500.	.4716811	Cap 5	74
73700.	.4600764	Cap 3	6
73790.	.4550501	Cap 50	11
73860.	.4511604	Cap 48	10
74360.	.4233228	Cap 11	8
74860.	.3940732	Cap 21	8
74890.	.3923108	Cap 14	18

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
75390.	.3628923	Cap 7	14
75490.	.3567835	Cap 4	65
75590.	.3506901	Cap 1	17
75790.	.3384362	Cap 5	75
75820.	.3366428	Cap 24	9
76020.	.3255325	Cap 8	35
76220.	.3150927	Cap 5	76
76320.	.3098425	Cap 2	11
76420.	.3047449	Cap 4	66
76620.	.2960040	Cap 5	77
77120.	.2746698	Cap 41	4
77320.	.2660770	Cap 8	36
77820.	.2444558	Cap 7	15
77880.	.2418471	Cap 37	7
77980.	.2375884	Cap 4	67
78000.	.2367596	Cap 13	8
78200.	.2290436	Cap 5	78
78300.	.2251970	Cap 1	18
78800.	.2064961	Cap 21	9
79300.	.1873439	Cap 11	9
79330.	.1862275	Cap 14	19
79360.	.1851505	Cap 34	13
79450.	.1819625	Cap 50	12
79490.	.1805547	Cap 15	8
79590.	.1770995	Cap 4	68
79790.	.1703580	Cap 8	37
79990.	.1636827	Cap 5	79
80060.	.1614197	Cap 48	11
80260.	.1554461	Cap 3	7
80760.	.1409904	Cap 7	16
80960.	.1355472	Cap 5	80
81060.	.1328456	Cap 2	12
81160.	.1301370	Cap 4	69
81360.	.1253212	Cap 8	38
81390.	.1246118	Cap 24	10
81490.	.1224228	Cap 1	19
81690.	.1180902	Cap 5	81
81790.	.1160765	Cap 4	70
82290.	.1067022	Cap 21	10
82790.	.0972285	Cap 11	10
82820.	.0966712	Cap 14	20
83020.	.0932340	Cap 5	82

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
83520.	.0846439	Cap 7	17
83720.	.0812983	Cap 8	39
83810.	.0798965	Cap 50	13
83910.	.0783811	Cap 4	71
83980.	.0773208	Cap 38	8
84010.	.0768852	Cap 34	14
84040.	.0764495	Cap 44	14
84540.	.0696583	Cap 41	5
84740.	.0669599	Cap 5	83
84800.	.0661573	Cap 27	8
84860.	.0653540	Cap 37	8
84930.	.0644712	Cap 48	12
84950.	.0642364	Cap 13	9
85050.	.0631195	Cap 1	20
85150.	.0620126	Cap 2	13
85350.	.0598017	Cap 8	40
85450.	.0586995	Cap 4	72
85650.	.0566413	Cap 5	84
85730.	.0558298	Cap 49	8
85770.	.0554243	Cap 15	9
85970.	.0534868	Cap 3	8
86470.	.0487642	Cap 7	18
86500.	.0485127	Cap 14	21
86550.	.0481040	Cap 26	9
86600.	.0476952	Cap 46	9
87100.	.0436070	Cap 31	11
87600.	.0395011	Cap 11	11
88100.	.0353777	Cap 21	11
88200.	.0345835	Cap 4	73
88400.	.0330097	Cap 5	85
88600.	.0315738	Cap 8	41
88630.	.0313598	Cap 24	11
89030.	.0288886	Cap 10	9
89120.	.0283507	Cap 50	14
89320.	.0271828	Cap 5	86
89420.	.0266277	Cap 4	74
89520.	.0260989	Cap 1	21
89550.	.0259457	Cap 44	15
89580.	.0257925	Cap 34	15
90080.	.0233564	Cap 7	19
90280.	.0224638	Cap 8	42
90480.	.0216071	Cap 5	87

Total Investment	Risk Accepted	Capability Acquired	Number of Units Acquired So Far
90550.	.0213088	Cap 48	13
90650.	.0209021	Cap 2	14
90750.	.0205200	Cap 4	75
90820.	.0202573	Cap 38	9
90850.	.0201514	Cap 14	22
91350.	.0185807	Cap 11	12
91850.	.0170075	Cap 21	12
92350.	.0154317	Cap 31	12
92410.	.0152437	Cap 37	9
92470.	.0150556	Cap 27	9
92530.	.0148675	Cap 17	9
92730.	.0142450	Cap 5	88
92820.	.0139700	Cap 40	4
93320.	.0124705	Cap 41	6
93520.	.0119275	Cap 8	43
93720.	.0114061	Cap 3	9
93820.	.0111456	Cap 4	76
93840.	.0110940	Cap 13	10
93930.	.0108642	Cap 30	5
93970.	.0107687	Cap 15	10
94050.	.0105797	Cap 49	9
94550.	.0093988	Cap 7	20

Final Results

Name	Quantity	Risk by Capability
Cap 1	21	.0003970
Cap 2	14	.0001952
Cap 3	9	.0001542
Cap 4	76	.0004935
Cap 5	88	.0014520
Cap 6	6	.0000000
Cap 7	20	.0009397
Cap 8	43	.0007357
Cap 9	5	.0000000
Cap 10	9	.0010239
Cap 11	12	.0008051
Cap 12	13	.0000003
Cap 13	10	.0000119
Cap 14	22	.0000668

Name	Quantity	Risk by Capability
Cap 15	10	.0000242
Cap 16	5	.0000003
Cap 17	9	.0000465
Cap 18	10	.0000130
Cap 19	5	.0000000
Cap 20	13	.0000001
Cap 21	12	.0008051
Cap 22	9	.0000000
Cap 23	6	.0000000
Cap 24	11	.0000714
Cap 25	13	.0000001
Cap 26	9	.0001208
Cap 27	9	.0000465
Cap 28	5	.0000000
Cap 29	7	.0000000
Cap 30	5	.0000229
Cap 31	12	.0008051
Cap 32	11	.0000085
Cap 33	10	.0000119
Cap 34	15	.0000690
Cap 35	11	.0000045
Cap 36	10	.0000242
Cap 37	9	.0000465
Cap 38	9	.0000693
Cap 39	5	.0000000
Cap 40	4	.0000182
Cap 41	6	.0003201
Cap 42	11	.0000000
Cap 43	12	.0000003
Cap 44	15	.0000690
Cap 45	14	.0000000
Cap 46	9	.0001208
Cap 47	11	.0000014
Cap 48	13	.0001259
Cap 49	9	.0000465
Cap 50	14	.0002723
Total Risk	.0093988	
Total Cost	94550.	

Stop - Program terminated.

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A model is presented which could be used to conduct risk analysis under the scenario planning framework being developed by the Directorate of Defence Analysis (DDA). DDA has presented a minimum set of 11 scenarios based on the commitments that have been described in the 1994 White Paper. They have developed a work program which over the next 12 months will expand these scenarios, identify the defence capabilities required to be successful in these scenarios, quantify these capabilities, and prioritize the Canadian Forces capability development to provide minimum risk at minimum cost. The following model is suggested as a potential method for quantifying the cost/risk relationship in a realistic manner to optimize the capabilities of the Canadian Forces.

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